

PROSPECTUS
FOR
FARM MECHANIZATION PROJECT

October, 1971

The Government of the Republic of Korea
Seoul, Korea

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FOR
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Summary of the Project

1. Project Title : Farm Mechanization Project
2. Project Sponsor : National Agricultural Cooperative Federation

3. Estimated Fund Requirement for the Project:

Foreign Funds : US\$20,000,000.

Local Currency: 3,160,000 thousand won.

4. Project Description:

This project is to provide farmers with necessary funds for their purchase of farm implement such as power tillers and sprayers, for the projected mechanization of agriculture, during the Third Five Year Economic Development Plan period.

(Unit: Million won)

Item	Quantity (set)	Total Fund Requirement			Remarks
		Local	Foreign	Total	
Power tillers	20,000	2,280	5,320	7,600	
Power sprayers	5,000	175	575	750	
Mist sprayers	33,571	705	705	1,410	
Total	38,571	3,160	6,600	9,760	
(US\$20 million)					

5. Benefits of the Project:

By substituting farm machinery and equipment to increase productivity of agriculture during shorter working periods for farm labor forces, which are decreasing, and with double cropping facilitated under this approach, farmers' net incomes will increase and their general standard of living improved.

The indirect benefits attributed to this mechanization project will be numerous and significant. They are described in CHAPTER IV on page 34.

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CHAPTER . I.

MECHANIZATION OF AGRICULTURE IN KOREA

CHAPTER I. MECHANIZATION OF AGRICULTURE IN KOREA

1. Introduction

The mechanization of the Korean agriculture sector has just started and the per cent rise of power equipment in use has been increasing rapidly. However, the absolute level of mechanization is low, only one or two per cent of the level of Japan.

Within the agriculture sector in Korea, dramatic changes are taking place, offsetting the earlier constraints to farm mechanization and increasing the rate of mechanization. Chief among these is the change from a labor surplus to a labor deficit economy. The number of workers in the rural areas reached a peak in 1964, and began to decrease as farm workers have been drawn into industrial production. Farm wages have increased much faster than the rise in other prices paid by farmers, particularly since 1970. At the end of 1970 farm wages were nearly triple the 1965 level, whereas farm equipment prices had risen only 35 to 75 per cent. The real wage of farm workers had increased 52 per cent from 1965 to October, 1970.

In the next few years, the high labor-saving potential of some farm equipment promises to be the main stimulus to mechanization. The effects of a rapidly modernizing industrial-commercial sector clearly indicate that the chief advantage of mechanization to farmers is the labor saved. The release of labor from the agriculture sector, to meet labor demand in other sectors, is both desirable and a prerequisite for transition from a rural to an industrial economy. Therefore, technological unemployment from farm mechanization is not a long run problem but a sought-after goal.

The vast majority of Korean farms are small in size, but the size distribution is almost the same as in Japan, where more than 3 out of every 5 farms own a power tiller. Korea has 169,000 farms larger than 2.0 hectare and a preliminary study indicates that mechanization of these farms is technically feasible and profitable, and that the farmers have sufficient resources to finance the purchase of equipment, if credit practices and institutions common to modern agricultural economics are adopted.

The farmers themselves give various indications that their demand for equipment is not being met fully.

There is evidence to suggest that farmers are willing to pay more than the NACF selling price of tillers and other farm machinery. In 1970, NACF also received more applications for tillers than the 3,581 it was able to supply. The Dae Dong Industrial Co., one of the farm machinery manufacturers, states that during 1970 its branch offices received inquiries from 16,500 farmers prepared to pay 50 to 60 per cent cash for tillers.

In short, the mechanization of agriculture in Korea is one of the great important projects for attaining self-sufficiency and economic progress and stability in this country, which is the primary objective of the Korean Government, to be attained during this decade of the 1970's.

Accordingly, during the Third Five Year Plan (TFYP) (72-76) the central government expects to provide 50 million dollars (foreign loans and local funds) annually for this mechanization project.

2. Extent of Mechanization

The farm mechanization process commenced only recently in Korea and, as a result, large farm equipment, such as four-wheel tractors and combines, are virtually unknown to farmers. At the end of 1968, only 108 four-wheel tractors

were in use. However, there has been, particularly in the last four years, a significant increase in the number of small power equipment in use on farms. Even the percentage increase in the number of power tillers has been large--above 40 per cent each year since 1962 (table 1).

Nevertheless, the absolute level of mechanization is still low with only 12,882 tillers in use in 1970, an average of one tiller for each 194 farm households. If we compare the number of power tillers in use with the number of farm households on farms of one hectare or more we find there is only one tiller per 55 households. This fact, of course, raises the very important issue that 66.4 per cent of farm households are on farms of less than one hectare in size. The use of power irrigation pumps and power sprayers and dusters is considerably more widespread but there is still only one irrigation pump, for example, per 43 farm households.

These data are clear evidence that while the use of small power equipment is not yet widespread in Korea, farmers are recognizing the advantages of some forms of mechanization. The trend toward increased use of small power equipment also suggests that changes are taking place in the agriculture .

sector which are making mechanization more attractive and, presumably, more profitable than during earlier years.

In spite of significant increases in the use of farm equipment, the absolute volume has not been high enough to raise the ratio of the value of farm equipment to fixed agricultural capital, excluding land. This ratio has remained about 3 per cent and was even somewhat lower in 1968 than in 1962 and 1963. However, price changes of fixed agricultural capital may obscure the increased use of equipment.

In comparison with Japan, where the value of farm equipment is nearly 20 per cent of fixed agricultural capital, the level of mechanization in Korea is low.

Data also show the low average expenditure on farm implements which from 1962 through 1968 accounted for well under two per cent of the production costs of rice farmers. However, the increased use of farm equipment has begun to influence production cost percentages noticeably, and to stimulate farmers' desire for some form of mechanization.

(Table.1)

Quantity of Power Equipment on Farms(1960-70).

Year	Power Tillers		Power Sprayers and Dusters		Power Threshers		Irrigation Pumps	
	Q'ty	% In-crease	Q'ty	% In-crease	Q'ty	% In-crease	Q'ty	% In-crease
1960	153	-			3,886	-	6,911	-
1961	30	-80.4	310	-	4,794	23.4	3,736	-45.9
1962	23	210.0	714	130.3	8,022	67.3	12,292	229.0
1963	386	315.1	3,071	330.1	9,495	18.4	13,171	7.2
1964	653	70.0	5,133	67.3	14,610	53.9	15,350	16.5
1965	1,111	70.2	7,579	47.7	18,909	29.4	26,029	69.6
1966	1,555	40.0	8,798	16.1	22,338	18.1	29,929	15.0
1967	3,819	145.6	12,768	45.1	25,474	14.3	31,613	5.6
1968	6,225	63.0	11,568	-9.4	26,675	4.7	37,796	19.6
1969	8,832	41.9	24,721	130.7	33,878	27.0	49,534	31.1
1970	12,512	41.7	39,872	61.3	33,878	0.	57,447	16.0

Source: Agricultural Year Book 1970.

3. Economic Trends Encouraging Mechanization

(1) Korea no longer a labor surplus economy

Korean agriculture is no longer a labor-surplus sector. At the beginning of the decade (1960) Korea was characterized as a labor surplus economy with large amounts of excess labor in the agricultural sector. By the end of the period this situation was radically different. The high rate of economic growth, particularly in manufacturing, but also in the other non-agricultural sectors, resulted in a migration of labor out of the agricultural sector. Through this process the surplus labor supply has been absorbed. This can be demonstrated by observing the real wage rate. In a surplus labor economy, the migration of labor out of agriculture and into the non-agriculture sectors would not effect the real wage since the labor was redundant. However, once the redundant labor had been absorbed by the non-agriculture sectors, additional outmigration would result in increases in the real wage.

Table 2 gives the real wage index from 1959-70. The real agricultural wage remained constant from 1959 to 1962. After 1962 the real wage has risen each year. The 1969 level is about 50 per cent above the 1962 level. This result supports the contention that in agriculture Korea has moved beyond a labor surplus economy stage and is now an economy where labor is scarce. In such an economy, labor saving mechanization frees labor to move to alternative areas of higher productivity, e.g., manufacturing.

(Table 2)

Indexes of Farm Wages, Farm Household
Goods and Real Farm Wages

Year	(1) Index Farm Wages	(2) Price Index Farm House- hold Goods	(3) Real Wage (1) / (2)
1959	42.6	51.0	83.5
1960	43.1	53.3	80.9
1961	47.6	57.0	83.5
1962	51.5	62.3	82.7
1963	65.2	69.6	93.7
1964	88.5	89.8	99.6
1965	100.0	100.0	100.0
1966	116.9	112.1	104.3
1967	142.7	126.4	113.0
1968	178.3	145.7	122.4
1969	216.4	159.0	136.1
1970	285.5	187.7	152.1

Source: Bank of Korea, Monthly Economic Statistics.

(2) The Third Five Year Plan Projections

The period of the TFYP (1972-76) is likely to bring a continuation, and perhaps an acceleration of existing trends. The TFYP calls for a continuing high growth rate in the non-agricultural sectors with over-all GNP increasing 8.5 per cent annually.

Manufacturing output is projected to grow at an annual rate of 12.7 per cent and agriculture at a substantial 4.5 per cent annual rate. The agricultural labor force is expected to decline as labor moves out of agriculture into non-agricultural employment. To meet the TFYP targets for agriculture will require labor productivity to increase 41 per cent between 1969 and 1976. The effect of the decrease in the agriculture labor force will, no doubt, result in further upward pressure on farm wage rates continuing the trend of wages rising more rapidly than the prices of other agricultural inputs and in the accelerated need for farm mechanization.

(Table 3)

Agricultural Workers, Output, and Labor
Productivity Actual and Projected
1963-76

Year	(1) Workers in Agriculture (Thousands)	(2) Agriculture output (in 1969 Constant Won)	(3) Percent Change	(4) Labor Pro- ductivity Index (2) / (1)
<u>Actual</u>				
1963	4,822	494,442		100.0
1964	4,906	573,453		117.0
1965	4,784	567,048		119.6
1966	4,851	629,411		126.5
1967	4,706	612,398		126.9
1968	4,643	619,948		130.2
1969	4,660	703,888		147.3
1963-69			42.4	
<u>Projected</u>				
1970	4,586	718,249		152.7
1971	4,540	746,886		160.4
1972	4,516	780,090		168.5
1973	4,463	809,407		176.7
1974	4,398	837,378		185.7
1975	4,379	875,338		194.9
1976	4,340	911,196		204.8
1970-76			29.5	

Source: Economic Planning Board, Sector Model.

(3) Relative Change in Input Prices

The trends of the 1960's and the projections of the TFYP demonstrate the fundamental structural changes that are occurring and are expected to continue in Korea. These trends all point toward the need for increasing labor productivity in agriculture and the substitution of non-labor inputs for the previously cheap and plentiful labor. Substantial movement in this direction has already been underway for a number of years.

Up to the present, farm input substitutions has largely taken the form of chemical inputs although a significant amount of mechanization has also occurred.

Increased utilization of chemical inputs are expected to continue.

Farm input prices have changed very disproportionally since 1965 with farm machinery prices increasing from 50 to 75 per cent while by October 1970 farm wages had increased nearly 200 per cent.

Thus, the changes in input prices have encouraged mechanization markedly.

4. Constraints to Mechanization

(1) Low wage rates.

Along with other characteristics of farming in Korea, low wage rates relative to the rest of the world have tended to discourage Korean farmers from introducing imported agricultural equipment and encouraged continuation of labor-intensive technology. As domestic wages rise without offsetting increases in the exchange rate, duties, or foreign prices, imported machinery becomes more profitable to adopt. A simple comparison of Korea's farm wages follows.

Farm Wages in Korea and The United States 1965-70

Year	Korea		U.S.		Per cent Korea/U.S.
	Male Wage/day	<u>1/</u> In U. S. Dollars <u>2/</u>	Wage Per day	<u>3/</u>	
1965	₩ 221	.82	\$ 7.60		10.8
1966	256	.95	9.00		10.6
1967	307	1.12	9.90		11.3
1968	381	1.36	10.90		12.5
1969	463	1.60	10.30		15.5
1970	585 <u>a/</u>	1.89	11.30 <u>b/</u>		16.7

1/ Adult male, in cash and kind.

2/ Converted at annual average exchange rate

3/ Without board and room. a/ July B/ April 1.

Source: Agricultural Cooperative Monthly Survey, May 1970 and

Statistical Abstract of the United States, 1970.

Similarly, low farm wage rates compared with farm equipment prices delay the introduction of locally produced farm equipment. Since 1965, however, farm wage rates have increased much faster than either imported or domestically produced equipment prices, which is making mechanization more and more profitable.

(2) The small size of farms

The small size of Korean farms has prevented farmers from utilizing large farm equipment efficiently and from accumulating enough saving to pay the purchase price of relatively expensive farm equipment. While the per cent of farms under one Chongbo in size has declined from 73 per cent in 1960 to 66.4 per cent in 1969; the fact remains that about two thirds of the farms cultivate less than 2.5 acres. Only 1.6 per cent of the farms cultivate more than 7.5 acres. Given the inaccessibility of large farm tractors to small, traditionally cultivated farms, the lack of credit, and other obstacles, the use of large farm equipment has been excluded, in effect.

(3) Lack of credit institutions

While the commercial banks in Korea have an extensive network of branches throughout the country, they, like commercial banks elsewhere in the world, do not find the prospect of lending to individual farmers very attractive and lend virtually nothing to them.

This fact constitutes an impenetrable credit barrier between the farmer and much of the supply of loanable funds and compels most farmers to rely on NACF, which provides credit through Kun agricultural cooperatives.

Unfortunately, NACF funds for farm mechanization have been very limited, because the available credit has been devoted mostly to short-term purposes and because the total farm credit supply historically has been modest.

Farm experts believe that farmers obtain substantial amounts of credit from local, non-institutional lenders at high, market rates of interest. However, statistics on this source of loanable funds are not available.

5. Local Sources of Farm Implements

Two companies produce tillers--the Dae Dong Industrial Company Ltd. and the Chinil Machinery Company. The latter company, recently associated with Yanmar Diesel Co. in Japan to create the Hanil Farm Tools Co., started production of a diesel engine tiller in 1970, and received an order for 1,667 8-HP tillers from the 1970 budget of NACF at ₩362,000 each. The Dae Dong Industrial Company supplied 1,914 kerosene engine tillers to NACF in 1970--500 8-HP and 1,414 10-HP tillers. Dae Dong also sold 580 tillers directly to farmers for cash.

About 93 per cent of the Dae Dong tiller is made locally and 7 per cent of imported components. Local producers supplied 4,161 tillers in 1970. The table below gives the domestic production of major pieces of farm equipment from 1963 through 1968 and shows that substantial amounts of non-tractor power equipment are produced domestically.

Domestic Production of Major Farm Equipment

(Unit: Set)

Type	1963	1964	1965	1966	1967	1968
Engine(5-30HP)	5,083	10,620	10,120	3,860	5,820	8,200
Pump	2,251	14,301	20,500	3,825	6,710	9,300
Power tiller	305	266	340	677	2,616	5,371
Power sprayer	560	2,030	1,645	977	1,982	2,062
Manual "	38,366	58,440	45,000	49,500	67,000	75,000
High pressure sprayer (lever type)	8,600	300	2,500	4,500	5,000	17,000
Manual duster	5,500	7,500	980	500	350	300
Power thresher	738	918	1,430	1,470	1,570	1,200
Manual thresher	30,103	22,861	32,500	30,700	32,000	29,500

Source: Korea Farm Equipment Cooperative.

CHAPTER II

CONTENTS OF THE PROJECT

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1. Farm mechanization fund

A) Trend in Agricultural Financing

Farm credit supply historically has been very modest until recently, and the government subsidies and loans for the purchase of farm machinery by farmers, which the government started to provide for the first time in 1961, were small in amount and limited only for the purchase of small farm implements.

However, since 1965 the demand for loans for equipment buying has increased some what faster than that of other agricultural credit.

In October 1970, the equivalent of \$100.5 million of farm equipment loans were provided by, which was 39.2 per cent of all agricultural loans.

Furthermore the available credit has been mostly devoted to short-term purposes because the funds for farm mechanization has been restricted, although the amount of credit for equipment purchase has been considerably increased since 1965.

By 1970 the needs for farm machinery have dramatically changed because of: (1) the out-migration of farm workers to the industrial sector and (2) greater reliance on power farm equipment and transportation.

As out-migration continues, there will be a growing need for the increased use of farm equipment for the continuous higher crop yields.

B) Necessity of this loan fund

because farm machinery is expensive, relative to the average farm income, it is inevitable for the government to support farmers by releasing loans and/or subsidies for the farm equipment purchase, in order to effectively introduce farm mechanization to Korean agriculture, to substitute farm machinery for the decreasing labor force. The Government has made one of the TFYP goals, the provision of farm mechanization; financial resources will be supplied by the Government budget and foreign loans. The NACF will make use of such funds only for the support of farm mechanization, to assist farmers to buy farm machinery and the manufacturers to produce them.

And the fund will be used on a revolving basis, in consideration of the importance and the life-span of machinery to be supplied. Accordingly, the full amount of this loan will be used as partial capitalization of the mechanization fund.

As indicated above, the fund is absolutely necessary for satisfactory realization of farm mechanization in Korea.

2. Description of the Loan Project

The Government proposes to supply 43,740 power tillers, 1,940 seed spreaders, 3,900 weeders, 1,940 cutters, 1,940 limedusters, 13,500 power sprayers, 22,995 water pumps, 26,800 threshers and 84,300 mist sprayers during the course of TFYP.

This loan fund will be put into the Farm Mechanization Fund and will be granted to farmers for supplying 20,000 power tillers and 5,000 power sprayers with 33,571 mist sprayers. These amounts are within the total of the above-mentioned machinery.

70% of the purchasing price of a power tiller (30,000 won), and 70% of the purchasing price of a power sprayer (150,000 won), and 50% of the purchasing price of a mist sprayer (42,000 won), as is shown in the following table, will be lent to farmers from this loan fund.

Loan Amount Required per Set

Unit: Thousand won

Item	Financed per set	Paid by Farmer's	Purchasing price per set
Power tillers	266	111	380
Power sprayers	115	35	150
Mist sprayers	21	21	42

Total Requirement

Unit: Million won

Item	Quantity	Total Amount Required		
		Local	Foreign	Total
Power tillers	20,000	2,280	5,320	7,600
Power sprayers	5,000	175	575	750
Mist sprayers	33,571	705	705	1,410
Total	58,571	3,160	6,600	9,760

(US\$20,000 thousand)

The NACF participation in the Farm Mechanization Fund, the loan amount per unit, and loan conditions are shown in the following tables.

Price paid by Farmers (1970)

Unit: won

Item	Paid by farmers	NACF loan	Gov't subsidy	Total
Tiller (6 HP)	161,238	101,400	75,362	338,000
" (8 HP)	169,876	108,330	82,894	361,100
" (10HP)	172,775	111,270	93,855	380,900
Sprayer(45HP)	4,227	102,857	42,270	145,127
Mist sprayer(2HP)	3,944	34,358	34,358	43,260

Grace period: One year

Repayment period: Four years

Interest : 9% per annum.

Number of Farm Machinery to be Supplied and Amount of
Investment in Farm Mechanization

(Unit: Million Won)

Commodity	Total Number to be Supplied				Number to be supplied and amount of investment by year											
	Number (Set)	1972		Total	Number (Set)	1973			Number (Set)	1974			Number (Set)	1975		
		Local Funds	Foreign Funds			Local Funds	Foreign Funds	Sub- Total		Local Funds	Foreign Funds	Sub- Total		Local Funds	Foreign Funds	Sub- Total
Power tillers	20,000	2,280	5,320	7,600	5,500	627	1,463	2,090	6,700	763.8	1,782.2	2,546	7,800	889.2	2,074.8	2,904
Power Sprayers	5,000	175	575	750	2,500	87.5	287.5	375	2,500	87.5	287.5	375	-	-	-	-
Mist Sprayers	33,571	705	705	1,410	13,800	289.8	289.8	579.6	15,500	325.5	325.5	651	4,271	89.7	89.7	179.4
TOTAL:	58,571	3,160	6,600	9,760	21,800	1,004.3	2,040.3	3,044.6	24,700	1,176.8	2,395.2	3,572	12,071	978.9	2,164.5	3,143.3

NOTE: 1. Local fund will be covered by farmers' cash payment for equipment purchases.

3. Operation of the Loan Fund

The Government of Republic of Korea (ROKG) applies for a loan in the amount of US\$20,000,000 in order to execute effectively this farm mechanization project in Korea.

ROKG will relend the loan fund to the National Agricultural Cooperative Federation through Special Account for Foreign Loan Fund Management of the ROKG, and NACF will put the fund into the Farm Mechanization Fund and in turn relend the fund to subproject sponsors to buy power tillers and power sprayers under procedures and conditions decided previously.

NACF will have the right to revolve in accordance with the purpose and conditions of proposed subloan. Any partial loan amount collected from end-users after grace period are to be retained and revolved until NACF's repayments to ROKG in compliance with the Amortization Schedule. NACF will take charge of collecting the loan fund from end-users and repaying the fund to the Government.

4. Economic Feasibility

Agriculture mechanization can be economically feasible, given certain underlying cost relationships. A farm implement becomes economically feasible when the costs associated with mechanization become equal to or less than the costs associated with the traditional methods. The Agricultural Economic Research Institute of the Ministry of Agriculture and Forestry has estimated the size of a farm and degree of utilization (days worked) required for the economic feasibility of various farm implements. The results of the study indicate that for most of the farm implements examined, there is a farm size at which the implement will be economically feasible, given Korean prices. The break-even size farm (size at which mechanization becomes economically feasible) varies considerably, depending on the implement, but in most cases the break-even size is under 10 hectares and in 4 cases the break-even size is under 3 hectares. In 1969, Korea had 169,904 farms over 2 hectares and 39,421 farms over 3 hectares. Thus, despite the small farm size, a large number of Korean farms are of sufficient size to economically utilize some forms of mechanization.

Also, small farm size alone need not preclude mechanization, since both cooperative farming and custom farming i.e., rental of the farm implement and associated labor service, can increase implement utilization to the point of economic feasibility..

And it is reasonable to expect that mechanization will be profitable in Korea as labor becomes more and more scarce, farm wages rise, and farm incomes increase.

CHAPTER III

GOVERNMENT PROJECTION FOR FARM MECHANIZATION

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The Ministry of Agriculture and Forestry recently has announced a plan for farm mechanization during the TFYP period.

1. Principles

- 1) For small-scale farms in hilly areas--distribution of small-size power machinery (Ex: power tillers and dusters and sprayers around 5 HP).
- 2) For farm lands in the plain with available irrigation water and rearranged land--distribution of medium-size power-machinery (Ex: power tiller around 8-10 HP).
- 3) For paddy fields--distribution of irrigated pumps against drought damage and power transplanters for reduced peak labor demand.
- 4) Supply of big-size farm machinery conducted on a joint-use basis, while small-size ones will be privately owned.
- 5) Encouragement of livestock breeding as sub-lines and/or as a primary activity in order to maintain soil fertility.
- 6) Granting long-term loans with low interest to both producers and end-users of farm machinery.

7). Every item of farm machinery to be distributed, as a general rule, to be a domestic product.

(Linking manufacture as together on a production line by kind of machinery).

2. Estimated Demand (Requirements)

1) Power tillers

Of 1,170 thousand hectares to be irrigated, 450 thousand hectares will be mechanized until 1976 by supplying power tillers.

2) Motor pumps

Substitution for the worn-out, existing 57,447 sets in the area of 141,029 ha, where proper measures have been taken against weather damage (drought).

3) Transplanters

Supply power transplanters to 600,000 hectares of area to be rearranged, with details for the total supply to be related to the results of the experimental use of transplanter in 1971.

4) Sprayers and dusters

The whole paddy rice areas of 1,293,000 ha will be

covered by the mechanization project, thus shortening the days worked per time for anti-disease work from 8 days in 1971 to 6 days in 1976.

5) Harvesters

Rearranged area of 600,000 ha will be covered in the mechanization project. The distribution plan for combines and drying machines will be based on the results of experiments connected with the cultivation of IR 667 in 1971.

3. Means and Measures for Promoting Farm Mechanization

- 1) Sources of funds required for the farm mechanization project consist of the government budgetary fund and loans from international organizations and bilateral lenders.
- 2) Manufacturers of farm machinery, chosen in connection with the project, will be required to establish farm marketing networks throughout the country so as to supply directly the machinery to farmers, who want to purchase. Manufacturers will be required to warrant their machinery for specified periods of time.
- 3) A few mechanics will be assigned to every market store to assure warranty satisfaction, provide whatever service is necessary, also purchase and supply parts or accessories.

4). All the technological training for the maintenance of farm machinery will be supervised by the Farm Machinery Operators Training Center in ORD, except for farming tractors. And the training will be performed at national, provincial, Kun (County), Eup (Town) and Myon levels respectively, with the cooperation of the producer-supplier of the farm machinery. Training for the operation and management of tractors will be undertaken by the Agricultural Development Corporation (ADC).

(Table 1)

Projection for Supplying Major Farm Machinery

(Unit: Each)

Kind of Machines	Machinery and attachments	Number to be supplied by Year						Total (71-'76)
		1971	1972	1973	1974	1975	1976	
Power Tillers	Tillers	5,000	5,500	6,700	7,800	8,740	10,000	43,740
	Plows							
	Rotaries							
	Trailers							
	Seed spreaders		310	340	350	420	520	1,940
	Seeders		620	680	720	840	1,040	3,900
	Cutters		310	340	350	420	520	1,940
	Lime dusters		310	340	350	420	520	1,940
	Sprayers	2,500	2,500	2,500	2,500	3,000	3,000	16,000
	Threshers		2,000	3,000	4,800	7,000	10,000	26,800
Irrigation pumps			2,880	2,880	5,745	5,745	5,745	22,995
Dusters and Mist-Sprayers		14,000	13,800	15,500	16,500	18,500	20,000	108,300

*MAP estimates the cost of a power tiller (on the basis of 8 HP) with attachments (Plow, rotary and trailer) at 380,000 Won (about 1,200 U.S. dollars).

CHAPTER IV. BENEFITS OF THE PROJECT

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Economic Feasibility of Farm Mechanization

(1) Main Point to be analyzed.

The ultimate purpose for utilization of farm machinery is to increase agricultural productivity and increase farmers' income. However, since the farm machinery is not the objective of labor, in the strict sense, such as seeds, fertilizer or farm chemicals, but in a narrow-sense, producing means that enhance the efficiency of human labor (physical work), the effect of mechanization on agricultural productivity and farmers' income is always indirect. Consequently it is too difficult to estimate the indirect effects by mechanization, much more the secondary and tertiary effects on farmers' income earned when the labor saved by mechanization is employed in side businesses and off-farm industries.

Indirect effects deriving from farm mechanization is yet to be calibrated and must be related to actual circumstances. Even in Japan, where farm mechanization has been achieved to a fair degree under the agricultural conditions quite similar to those of Korea (in main crops, farm size, climates and etc.), only the macro-analysis is possible. It was concluded that farmers' incomes when utilizing machine has been increasing more rapidly than otherwise.

Therefore, estimates of the effects of mechanization cannot but be focused on the labor saved and costs saved, (which are regarded as direct effects) with only little consideration of indirect effects, mentioned above.

In short, agriculture mechanization can be economically feasible, given certain underlying cost relationships.

A farm implement becomes economically feasible when the costs associated with mechanization become equal to or less than the costs associated with the traditional methods.

(2) AERI's Analysis

The Agricultural Economic Research Institute of the Ministry of Agriculture and Forestry has estimated the size of a farm and degree of utilization (days worked) required for the economic feasibility of various farm implements. The results of the study ^{1/} indicate that for most of the farm implements examined, there is a farm size at which the implement will be economically feasible, given Korean prices. The breakeven size farm (size at which mechanization becomes economically feasible) varies considerably, depending on the implement, but in most cases the break-even size is under 10 hectares and in 4 cases the break-even size is under 3 hectares. In 1969, Korea had 169,904 farms over 2 hectares and 39,421 farms over 3 hectares.^{2/} Thus, despite the small farm size, a large number of Korean farms are of sufficient size to utilize economically some forms of mechanization. Also, small farm size alone need not preclude mechanization since both cooperative farming and custom farming and rental of the farm implement and associated labor service, can increase implement utilization to the point of economic feasibility.

As has been shown previously, ^{3/} the agricultural wage has risen rapidly both absolutely and relatively in recent years. This trend can be expected to continue. The break-even farm size is dependent on traditional costs which are largely labor costs. As the agricultural wages increase relative to the price of other inputs, the break-even farm size decreases. Under these conditions, the break-even farm size will decrease, enhancing the feasibility of agricultural mechanization. The study methodology ^{4/} can be briefly summarized: Estimates of (a) the minimum farm size (break-even point) permitting lower costs per land unit than traditional methods and (b) the number of "days worked" necessary to adequately utilize the implements on the break-even size farm, made under three alternative cropping pattern assumptions (Table 6). The number of "days worked" possible is estimated in Table 7. Table 8 relates break-even farm size with the maximum possible days worked as determined by the limited time periods. When the maximum days worked is less than the number of days worked possible, that type of mechanization is economically feasible for the break-even size farm.

Table summarizes the study's conclusions. ^{5/}

Note: AERI points out in its report that it is worthy of notice that in general, farmers' demands for farm machines are an expression of their desire to complete the necessary labor in the limited time periods, rather than to reduce their farming expenditures for wages. In other words, they need farm machines because they cannot keep on farming without mechanization, i.e., they can't purchase labor power well enough.

1/ AERI, Future Prospects of Farm Mechanization

2/ See Table 9

3/ Economic Feasibility of Mechanization

$$t + r^1 \cdot r \dots \dots \dots (1)$$

t : Annual fixed costs of implement per land unit

r¹ : Variable costs of implement per land unit

r : Traditional costs per land unit.

Break-even Point of Mechanization

$$t + r^1 = r \dots \dots \dots (2)$$

$$t = \frac{T}{S}$$

T: Annual fixed costs of implement

S: Farming scale (cropping area)

$$\frac{T}{S} + r^1 = r \dots \dots \dots (3)$$

$$S = \frac{T}{r - r^1} \dots \dots \dots (4)$$

S: Break-even point (Size of farm)

$$T: \lambda(P-S) + : S + P (B_1 + B_2 + B_3 \dots \dots \dots B_n)$$

P: Purchase price of implement

S: Scrape value (Residual value)

λ: Capital turnover coefficient

i: Capital interest rate

B: Stand-by cost coefficient (Fixed management costs)

(The rates of insurance due, repair cost, garage cost,
fixed lubricating oil cost and machine management cost)

R : Mainly labor cost per land unit

$r^1 =$ Fuel (oil) cost + wages + other wasting costs (respectively
per land unit)

- 5/ We should pay attention to the fact that the AERI's analysis
was conducted without considering the indirect effects of farm
mechanization, especially the effect on increased production
of crops attained by deeper plowing.

CHAPTER V

PROJECT SPONSOR

CHAPTER V. PROJECT SPONSOR

1. Description of the Project Sponsor

A. Official Title

The National Agricultural Cooperative Federation
(abbreviated as N.A.C.F.)

B. Address

75 1-ka, Choongjung-ro, Sudaemoon-ku, Seoul, Korea

Cable Address: "KONACOF, Seoul"

C. Establishment.

The National Agricultural Cooperative Federation was organized by consolidation of the Agricultural Cooperatives and the Korean Agriculture Bank through the enactment of the Agricultural Cooperative Act in 1961.

- a). The Korean Agriculture Bank, before consolidation, had been existed since 1957 as the government-owned bank, succeeding the Korean Agriculture Bank Limited, established in 1956, which was reorganized after the consolidation of the Federation of Financial Associations and local Financial Associations, activated in 1907.

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- a). The Korean Agriculture Bank, before consolidation, had been existed since 1957 as the government-owned bank, succeeding the Korean Agriculture Bank Limited, established in 1956, which was reorganized after the consolidation of the Federation of Financial Associations and local Financial Associations, activated in 1907.

- b) The then existing National Agricultural Cooperative Federation and Agricultural Cooperatives were organized in 1957 succeeding Industrial Associations, which had existed since 1926.

D. Purpose

Agricultural cooperatives were established, as is provided for in Article 1 of the Act, to assure the balanced development of the national economy by increasing agricultural productivity and improving the economic and social status of farmers through selfhelp cooperative societies of farmers.

E. Organization

a) Ri/Dong (Village) Cooperatives

A Ri/Dong Cooperative as an elementary unit is formed by the participation of more than 20 farmer members in the same village. Each member must own at least one share of stock with an upper limit of 100 shares. The par value of each share is 1,000 won. The number of primary cooperatives totaled 5,859 at the end of 1970.

b) Kun (County) Cooperatives

A Kun (County) Cooperative as a secondary society is

formed by more than 15 village cooperatives in the area of a county. Therefore, all the Ri/Dong Cooperatives are affiliated with Kun Cooperatives. The par value of one share of stock bought by a village cooperative is 5,000 won. The number of Kun Cooperatives totaled 140 at the end of 1970.

c) Special purpose cooperatives

A special purpose cooperative is formed by more than 50 farmers who are engaged in specialized agriculture. The par value of one share of stock bought by a member is 3,000 won.

The number of special purpose cooperatives totaled 148 at the end of 1970 including 54 horticulture cooperatives and 94 livestock cooperatives.

d) The National Agricultural Cooperative Federation

The National Agricultural Cooperative Federation (NACF) includes as participants all the county cooperatives and special purpose cooperatives which subscribe to the stock of NACF. The par value of a share of stock is 10,000 won. NACF membership includes 140 city and county cooperatives and 148 special purpose cooperatives.

F. Structure

- a) The NACF has its head office in Seoul and 9 branch offices in each of 9 provinces. NACF has as its policy making bodies, the General Assembly, the Representatives Meeting and the Administration Board. The main function of these policy making bodies is to plan overall basic policy and to approve all the business and budget plans of NACF. The General Assembly is composed of all the presidents of Kun Cooperatives and Special Cooperatives. The Representatives Meeting is composed of 29 presidents of county and special cooperatives as their representatives. The Administration Board consists of the President of NACF, the Minister of Finance, Minister of Agriculture and Forestry, the Governor of the Bank of Korea, three cooperative presidents and two outstanding scholars in the field of agricultural economics. As an executive body, NACF has a President, two executive Vice-President, six Vice-Presidents and two Auditors. The President of NACF is nominated by the President of the ROK Government with the recommendation of the Minister of Agriculture and Forestry. The President of

NACF has the responsibility of management and operation of all the activities of NACF. His term of office is three years. The auditors are elected by the General Assembly and inspect the business and property of NACF.

b) Kun (County) Cooperatives

A Kun cooperative has, as its own policy making body, a General Assembly and Board of Directors. The function of these two includes the amendment of by-laws, approval of business and budget plan, acquisition and disposal of property and making decision on important business matters. A Kun Cooperative has one president and two auditors as its officers. The President representing a cooperative directs and controls its activities and presides over the General Assembly and Board of Directors. Currently, the president is nominated by the president of NACF. Auditors are elected by the General Assembly and supervise the business and property of the cooperative. The Kun Cooperative has one executive manager and managers to execute the operations of the cooperative.

c) Special purpose cooperatives

A special purpose cooperative has for policy making a General Assembly and a Board of Directors, and their functions are the same as of the Kun Cooperatives, except for handling of credit service. A special purpose cooperative has a president, two auditors, an executive manager or one manager.

G. The Relationship between NACF and Kun Cooperatives

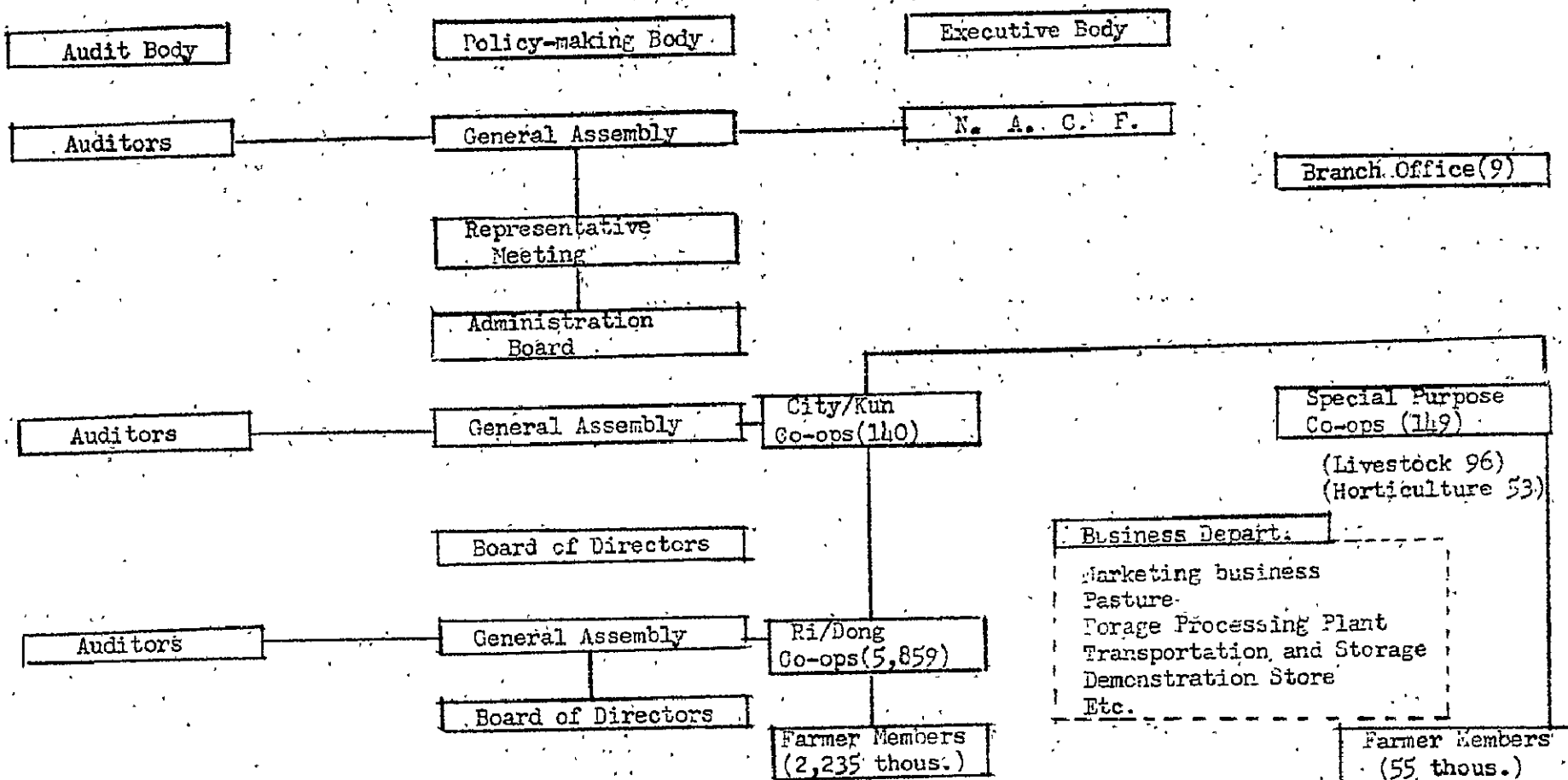
- a) Both NACF and Kun cooperatives are the independent legal entities as is provided for the Cooperative Act. However, NACF and Kun Cooperatives are entitled to conduct banking business on the basis of the Bank Act and, therefore, Kun Cooperatives are considered as branch offices of NACF.
- b) NACF is endowed with the authority to control and inspect the business of Kun Cooperatives for the efficient management of funds supplied by the NACF. In this case, NACF is entitled to issue necessary instructions or regulations for the guidances of Kun Cooperatives.

H. The Relationship with Other Banking Institutions

There are nine special financing banks including the Bank of Korea and nine commercial banks including community banks in Korea. The special financing banks are characterized by the purposes of financing specific fields of industrialization in the sectors they service. They are supervised and controlled by the Government. As the Korea Development Bank, Medium Industry Bank, National Citizens Bank, Housing Bank and other special banks release their financial credit for special fields of industry according to their purpose stipulated by their respective laws, NACF and its affiliated Kun Cooperatives are entitled to provide agricultural funds exclusively, despite the fact that these cooperatives are organized on the basis of the subscription by farmer members.

(Table 1)

ORGANIZATION CHART OF THE FEDERATION



(Table 2)

Number of Cooperatives in Each
City/Province

(As of 31 Dec. 70)

City/ province	Ri/Dong Coo'p	Kun Coo'p	Cooperatives		Remarks
			Special Coo'p		
			Horticulture	Livestock	
Seoul	85	1	1	4	
Pusan	90	1		2	
Kyunggi	450	18	7	10	
Kangwon	174	15	4	5	
Chungbuk	510	10	2	4	
Chungnam	854	15	9	15	
Junbuk	626	13	6	11	
Junnam	664	22	7	12	
Kyungbuk	1,247	24	6	14	
Kyungnam	1,007	19	10	16	
Je-ju	152	2	2	1	
			54	94	
Total	5,859	140	118		

(Table 3)

Equity Capital of NACF and Kun Cooperatives

(Unit: Million won)

	End of year 1965	1966	1967	1968	1969	1970
<u>NACF</u>						
Paid-in Capital	424	439	444	446	473	520
Reserve	456	472	484	609	627	2,082
Net Profit	76	51	49	59	67	77
Sub-total	956	962	977	1,114	1,167	2,679
<u>Kun Cooperatives</u>						
Paid-in Capital	524	584	631	715	823	1,060
Reserve	461	531	638	681	765	745
Net Profit	156	181	148	127	108	3,368
Sub-total	1,141	1,296	1,417	1,523	1,696	5,173
<u>Total</u>						
Paid-in Capital	948	1,023	1,075	1,161	1,290	1,580
Reserve	917	1,003	1,122	1,290	1,392	2,824
Net Profit	232	232	197	186	175	3,445
Total	2,097	2,258	2,394	2,637	2,863	7,849

2. Major Activities of NACF

NACF and its affiliated Kun Cooperatives handle such major activities as credit, banking business, purchasing of production materials for farmers, marketing of farm products for farmer members, mutual insurance, research, guidance, etc.

A. Credit Service

a) NACF and Kun Cooperatives as the exclusive financing institutions provide agricultural funds to the agricultural sector.

b) Source of funds

(1) Borrowings from the Government budget.

(2) Borrowings from the Bank of Korea.

(3) Deposits received.

(4) Agricultural debentures issued by cooperatives.

(5) Cooperative's own capital.

(6) Foreign loans.

c) Loan policy of NACF and Kun Cooperatives

NACF and Kun Cooperatives, before extending loans, appraise the creditibility and the project plan of borrowers and when the ability of amortization

and economic feasibility of the project are agreeable, the loans are granted. However, cash is held in the deposit account of borrowers at the lending offices; cash is withdrawn after the progress of the project and the purpose of the loan are ascertained. Each Kun Cooperative has field workers who make spot checks on the conditions of borrowers and management of the proposed project and receive reports on the progress of the project periodically. The trend in source and use of agricultural funds is shown in the following table:

(Table 4)

Trend in Agricultural Financing
(in balance)

(Unit: Million won)

Classification	1965	1966	1967	1968	1969	1970
<u>Source of Funds</u>						
Borrowing from Gov't budget	14,666	17,557	19,228	23,584	40,655	48,541
Borrowing from the Bank of Korea	4,012	2,126	4,102	2,447	1,377	2,673
Agricultural Debentures	898	465	223	166	121	83
Deposit Received	10,641	20,948	27,774	46,783	75,901	95,417
Foreign Loans					9,573	8,117
Total	30,217	41,096	51,327	72,980	127,627	154,831
<u>Uses of Funds</u>						
Short term agr. production	9,302	10,814	11,256	16,905	23,369	26,772
Medium term agr. "	6,663	7,660	10,754	17,946	35,481	32,961
Long-term agr. "	3,755	3,618	4,329	4,890	5,818	17,564
Sub-total	19,720	22,092	26,339	39,741	63,668	77,297
Fishery loans	136	774	1,347	1,919	4,580	4,634
Commercial loans	1,015	1,701	3,781	7,198	16,165	23,429
Others	9,346	16,529	19,860	24,122	43,214	49,471
Total	30,217	41,096	51,327	72,980	127,627	154,831

B. Fertilizer Business

Fertilizer is exclusively distributed by NACF and Kun Cooperatives to farmers. Private handling of fertilizer is prohibited in Korea. Fertilizer distribution is delegated by the government to NACF and the required fund for fertilizer is met by borrowings from the Bank of Korea under a government guarantee.

Fertilizer Supplied to Farmers by Year

Unit: Quantity; 1,000 M/T
Amount ; Million won

Year	1966	1967	1968	1969	1970
Quantity	1,287	1,339	1,345	1,422	1,612
Amount	23,696	22,581	24,076	26,589	30,176

C. Purchasing Business

Cooperatives supply various items of production materials including farm chemicals, seedlings, farm equipment, seeds, feeds, cattle etc., to farmer members.

Supply of Farming Materials by Cooperatives

(Unit: Amount; Million won)

Year Items	1966	1967	1968	1969	1970
Farm Chemicals	961	1,453	2,109	3,938	5,087
Farm Implements	472	798	920	2,051	2,218
Feeds	61	252	624	1,105	957
Seedling and Seeds, breeding stock	860	1,245	1,422	2 330	1,487
Other inputs for production	-	227	375	526	701
Total	2,357	3,975	5,445	9,950	10,450

D. Marketing Business

Cooperatives conduct marketing of farm products for farmer members to give economic benefits to them.

The major commodities handled include grains, vegetables, fruits, sweet potatoes, corns, cocoons, malting barley, straw goods and other cash crops. Recently, cooperatives have made a great stride in promoting exports.

The major export items include red beans, handicrafts, rush goods and hogs.

Marketing of Farm Products by Cooperatives

(Unit: Million won)

Year Items	1966	1967	1968	1969	1970
Grains	14,234	18,091	25,498	43,160	57,307
Potatoes	1,735	2,295	2,341	2,767	2,300
Fruits	757	923	1,221	1,716	2,047
Vegetables	567	661	727	1,417	1,622
Livestock products	51	76	112	120	110
Cocoons	3,089	3,580	6,537	7,594	9,229
Others	587	701	601	149	1,294
Total	21,020	26,317	27,237	57,283	73,911

E. Transportation and Processing and Storage

The utilization and processing business of cooperatives aims at the improvement of farm products for better quality and increasing income of farmer members through the joint utilization of facilities and processing plants. The major businesses included are warehousing, operation of feed mills and transportation services.

(Table #5)

Status of Utilization and Processing Business

		1966		1967		1968		1969		1970	
		Number	Quantity	Number	Quantity	Number	Quantity	Number	Quantity	Number	Quantity
Grain											
			Thous. bushel								
			9,608		6,144		6,680		8,510		1,093
Warehouse	1,660		Fertilizer	1,644		1,649		1,658			
			716M/T		687		1,538		651		1,265
Strawbag											
			Thous. bags								
			8,157		11,311		11,928		4,656		11,982
Feed Mixing	15		4,349M/T	11	22,923	16	42,000	16	64,000		16,558
Artificial Insemination	65		Thous. heads	118	43	165	73	165	115		145
			39								
Rice Milling	11		9,481M/T	11	8,537	10	7,622	7	3,000		
Transportation							249,240M/T		431,816		355,419

F. Mutual Insurance of Cooperatives

NACF and its affiliated Kun Cooperatives handle mutual life and property insurance for the protection of farmer members. Cooperative insurance is largely damage insurance for property (Fire and livestock) and life insurance. The fund accumulated through cooperative insurance is one of the major sources of the capital formation of cooperatives.

Operation Status of Mutual Insurance

(Unit: Million won)

Year Item	1966	1967	1968	1969	1970
<u>Supply</u>					
Payment Reserve	16	160	388	783	879
Claims Reserve	530	1,233	2,376	3,780	6,311
Contingent Reserve	155	189	297	445	521
Dividends	60	251	460	999	1,420
Mutual Insurance funds	63	88	116	150	194
Total	824	1,921	3,587	6,157	9,325
<u>Uses</u>					
Deposits	800	1,685	2,724	4,209	6,625
Loan		175	706	1,273	2,029
Others	24	61	157	675	671
Total	824	1,921	3,587	6,157	9,325

3. Foreign Loan Operation of NACF

(1) NACF borrowed one million Canadian dollars from the Canadian Government in 1968 and purchased dairy cattle and farm equipment to distribute to the farmers. And NACF also imported 120,000 M/T of grains from the CCC of the U.S. on a loan base and the converted won-currency is being used for the development of water resources for agriculture.

The terms and conditions of the loans are shown in the following table.

The Terms and Conditions of Loans

	Canadian Loan	U.S.A. Grain Loan
Loan Amount	One Million Canadian Dollars	US\$12,671,000
Interest Rate	3% per annum	2% during grace period, 2.5% for the rest
Amortization period	7 year grace and 23 year installment payment	10 year grace and 30 year installment payment

(2) The following table shows the total amount of loans
from various sources presently under progress by NACF.

(Unit: Thousand dollar)

Loan sources	Purpose of Loan	Loan amount	Remarks
IBRD	Horticulture and livestock development	US\$10,000 thous.	Expected loan agreement be signed in the later part of 1971.
West Germany	Milk and forage processing plant	4,500	Expected loan agreement to be signed in May, '71.
Japan	Cooling facility and equipment for diary-farming	5,000	Sub-loan agreement signed in Apr. '71.
A I D	Storage facility and farm equipment	14,000	Expected loan agreement signed in June, '71.
Japan	Credit for farmers and Highway construction	15,000	Under progress.
I D A	Storage facility for co-op's members	7,263	Under progress.
Total		US\$55,823 thous.	

(Table 6)

SUMMARY CALCULATION FOR BREAK-EVEN POINT

Type of Implement	Rate of Planting		With traditional methods	When implement is used		Break-even point		
	Rice	Barley	Hours needed	Costs	Variable costs 10 a	Annual fixed costs	Size of farm ^{1/}	Days worked ^{2/}
			(inc. animal labor Per 10a)					
	(%)	(%)	(Hrs)	(Won)	(Won)	(Won)	(Ha.)	(Days)
4-Wheel tractor	100	-	23.14	1,365	667		106.9	129.3
	100	50	48.01	2,832	1,001	735,899	40.7	67.3
	100	100	72.88	4,299	1,334		25.2	53.3
Power Tiller	100	-	23.14	1,365	730		11.2	50.2
	100	50	48.01	2,832	1,055	71,346	4.1	23.3
	100	100	72.88	4,299	1,460		2.5	17.0
Power Tiller (with thresher)	100	-	43.14	2,545	1,265		6.5	30.2
	100	50	77.51	4,573	1,898	82,882	3.1	24.6
	100	100	111.86	6,601	2,530		2.0	22.1
Rice Planter	100	-	22.6	1,333	180	89,540	7.8	16.8
Power Sprayer	100	-	51.8	3,056	992	12,893	0.63	2.0
High-efficiency Sprayer	100	-	51.8	3,056	802	58,055	2.6	3.1
	100	-	20.7	1,221	125		9.4	16.8
Binder	100	50	29.2	1,723	188	103,066	6.7	18.1
	100	100	37.7	2,224	250		5.2	18.6
Combine	100	-	40.7	2,401	303		11.7	23.7
	100	50	58.7	3,464	455	244,483	8.1	21.8
	100	100	76.7	4,761	686		5.9	21.2
Combine (With drier)	100	-	46.5	2,743	555		16.6	66.2
	100	50	66.5	3,923	833	364,172	11.8	70.6
	100	100	86.5	5,103	1,110		9.1	72.6

$$\frac{1/}{\text{Break-even point (Size of farm)}} = \frac{\text{Annual Fixed Costs}}{\frac{\text{Traditional Costs}}{\text{per Land Unit}} - \frac{\text{Variable Costs of implement}}{\text{Per Land Unit}}}$$

$$\frac{2/}{\text{Break-even point (Days worked)}} = \left(\frac{\text{Break-even point (Size of Farm)}}{\text{Area worked per day for each operation}} \right) \times \left(\frac{\text{Rate of Planting for each crop}}{100} \right)$$

(Table 7)

MAXIMUM AREAS FEASIBLE FOR WORK BY IMPLEMENTS
AND THE NUMBER OF DAYS WORKED

(At 100 per cent of planting rate)

Type of Implement	(1) Area actually worked Per hour	(2) Hours worked Per day	(3) Area worked Per day (2)x(1)	(4) Restrictive Factor	Work Period (days)	(6) Limit of Capacity of implement (3) x (5) (ha.)	(7) Number of days worked (days)
	10 area	Hrs.	10 area				
Tractor (rice-culture)	4.8	9.3	44.64	Ranking	12	53.6	64.8
Tower tiller	0.9	9.3	8.37	Ranking	12	10.0	44.8
Rice planter	0.5	9.3	4.65	Trans-planting	18	8.4	18.1
High-efficiency sprayer	6.4	9.3	59.52	Pest control	3	17.9	21.4
Power sprayer and duster	2.4	9.3	22.32	Pest control	3	6.7	21.4
Binder	0.6	9.3	5.58	Harvest	20	11.2	20.1
Combine	0.6	9.3	5.58	Harvest	20	11.2	44.7

$$(7) \text{ Days worked} = \frac{\text{Maximum workable area}}{\text{Area actually worked per day for each type of work.}} \times \frac{\text{Area planned for each crop}}{100}$$

(Table 8).

BREAK-EVEN FARM SIZE AND IMPLEMENT LIMIT CAPACITY

Type of Implement	Cropping pattern		Optimum size of farm		Optimum number of days worked		1/ Economics Feasibility
	Rice	Barley	Minimum (Break-even point)	Maximum (Limit of capacity of implement)	Minimum (Break-even point work volume)	Maximum (Limit of capacity work volume)	
	(%)	(%)	(Ha.)	(Ha.)	(Days)	(Days)	
Tractor	100	-	106.9		129.3	64.8	No
	100	50	40.7	53.6	67.3	87.4	Yes
	100	100	25.2		53.3	110.0	Yes
Power tiller	100	-	11.2		50.2	44.8	No
	100	50	4.1	10.0	23.3	56.4	Yes
	100	100	2.5		17.0	67.9	Yes
Power tiller (W. Thresher)	100	-	6.5		30.2	46.5	Yes
	100	50	3.1	10.0	24.6	78.3	Yes
	100	100	2.0		22.1	110.2	Yes
Rice Planter	100	-	7.8	8.4	16.8	18.1	Yes
Power Sprayer and duster	100	50	0.63	6.7	2.0	21.4	Yes
High-efficiency sprayer	100	100	2.6	17.9	3.1	21.4	Yes
Binder	100	-	9.4		16.8	20.0	Yes
	100	50	6.7	11.2	18.1	30.1	Yes
	100	100	5.2		18.6	40.1	Yes
Combine	100	-	11.7		23.7	20.1	No
	100	50	8.1	11.2	21.8	30.1	Yes
	100	100	5.9		21.2	40.2	Yes
Combine	100	-	16.6		66.2	44.7	No
	100	50	11.8	11.2	70.6	67.1	Yes
	100	100	9.1		72.6	89.3	Yes

1/ When the break-even point is larger than the maximum area that can be worked by an implement, the use of such an implement will be uneconomical.

(Table 9)

FARM HOUSEHOLD BY SIZE OF FARM

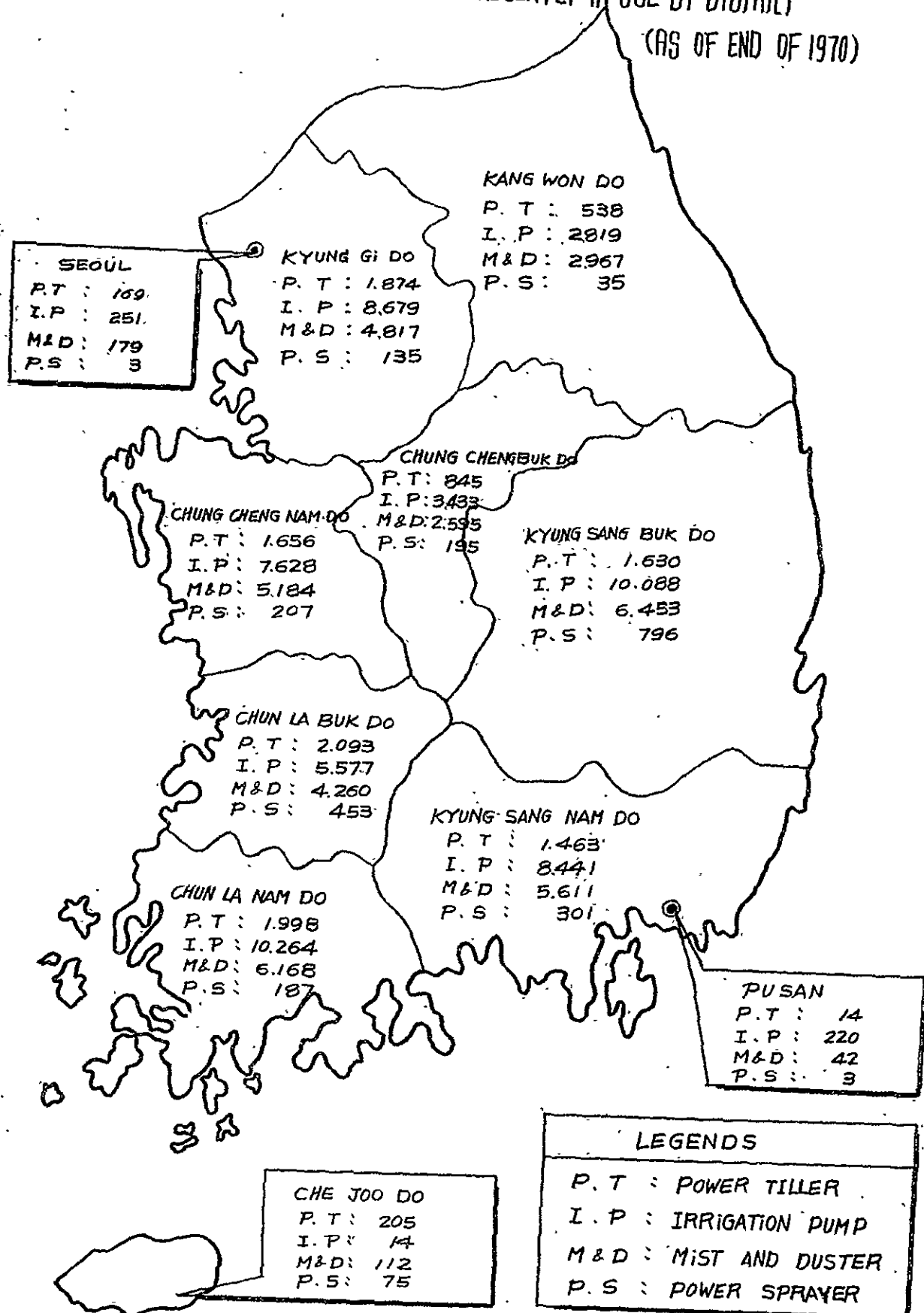
Size of Farm ^{1/} Chongbo	1960		1965		1968		1969	
	Number of Farm Households	% of Total	Number of Farm Households	% of Total	Number of Farm Households	% of Total	Number of Farm Households	% of Total
0-0.5	1,008,624	42.9	900,840	35.9	857,803	34.0	842,171	33.9
0.5-1.0	706,689	30.1	793,864	31.7	820,173	32.6	807,442	32.5
1.0-2.0	485,933	20.7	643,305	25.7	669,297	26.5	667,617	26.8
2.0-3.0	141,371	6.0	139,599	6.0	133,156	5.2	129,330	5.2
Over 3.0	6,889	0.3	29,291	1.1	40,626	1.6	39,421	1.6
<u>Total</u>	<u>2,349,506</u>	<u>100.0</u>	<u>2,506,899</u>	<u>100.0</u>	<u>2,521,055</u>	<u>100.0</u>	<u>2,487,134</u>	<u>100.0</u>

Notes: Excluding farms not engaged in crop farming.

1/ 1.0083 Chongbo = 1 Hectare = 2.471054 Acres.

Source: Year Book of Agriculture and Forestry Statistics.

NUMBER OF FARM MACHINERIES PRESENTLY IN USE BY DISTRICT (AS OF END OF 1970)



MAJOR RIVERS BASIN DEVELOPMENT

